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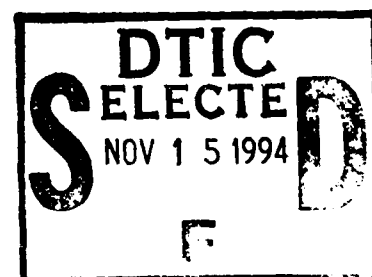
U.S. Army Research Institute
for the Behavioral and Social Sciences

Research Report 1669

# Performance Analysis of Table VIII Tank Gunnery Engagements

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**13. ABSTRACT (Maximum 200 words)**

To assess performance on individual Table VIII gunnery engagements, the first-run scores of 109 tank crews from three U.S. Army National Guard (ARNG) armor battalions were averaged and then ordinally ranked for difficulty. For all three battalions, three of the four engagements found to have the lowest average scores (highest difficulty rankings) required machine gun (coax or Caliber .50) employment either alone or in combination with the main gun. In the remaining engagement of this foursome, crews were required to fire at multiple targets with the main gun using the gunner's auxiliary sight. Two of the three engagements found to have the highest average scores (lowest difficulty rankings) involved presentation of only a single target. These results can be used by ARNG armor trainers to help maximize the payoff from their training time investment by focusing on the engagements found to be the most difficult, thereby enhancing the probability of first-run crew qualification on Table VIII.

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Research Report 1669

# ⁊rformance Analysis of Table VIII Tank Gunnery Engagements

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To enhance the efficiency and effectiveness of homestation tank gunnery training, the U.S. Army National Guard (ARNG) is encouraging the use of training devices. To this end, work is under way to develop a time-compressed, device-based tank gunnery training strategy for ARNG use at the company level. This strategy will recommend the training of specific gunnery tasks at the expense of others to promote efficiency without sacrificing existing performance standards. This report identifies specific gunnery engagements that should be emphasized during device-based, as well as tank-based, training to enhance first-run crew qualification rates on Tank Table VIII.

The research was conducted by the U.S. Army Research Institute Reserve Component Training Research Unit, whose mission is to improve the effectiveness and efficiency of Reserve Component (RC) training through use of the latest in training technology. The research task supporting this mission, "Train Up: Technology-Based RC Training Strategies," is organized under Science and Technology Objective V.B.7, Unit Training Strategies.

The National Guard Bureau (NGB) sponsored this research under a Memorandum of Understanding signed 12 June 1985. Results have been presented to Chief, Training Division, NGB; Chief, Training Division, Office of the Chief, Army Reserve; and Special Assistant to the Commanding General, U.S. Army Armor Center.

EDGAR M. JOHNSON
Director

# PERFORMANCE ANALYSIS OF TABLE VIII TANK GUNNERY ENGAGEMENTS

## EXECUTIVE SUMMARY

### Requirement:

This report assesses Army National Guard (ARNG) armor crew performance on Table VIII tank gunnery engagements.

### Procedure:

The first-run scores on each Table VIII engagement fired by 109 tank crews from three ARNG armor battalions were averaged and then ordinally ranked for difficulty.

### Findings:

For all three battalions, the same four engagements (A1, A2, A3, and B3) had the lowest average scores (highest difficulty rankings). The requirement for machine gun employment (coax or Caliber .50), either alone (A3) or in combination with the main gun (A2, B3), was suggested to be the primary cause of substandard performance (< 70 points) on three of these four engagements. Substandard performance on the remaining engagement (A1) of this foursome was suggested to be the result of an inability to apply manual lead with the gunner's auxiliary sight (GAS). In general, crews also scored higher on single target engagements than on multiple target engagements. The single target engagement, B1S, consistently had the highest average score (lowest difficulty ranking) across all three battalions.

### Utilization of Findings:

These findings suggest that the limited gunnery training time of ARNG armor units should be focused on four specific engagements to maximize the chances of first-run crew qualification on Table VIII. Doing so will promote training efficiency and effectiveness without compromising existing performance standards.

**PERFORMANCE ANALYSIS OF TABLE VIII TANK GUNNERY ENGAGEMENTS**

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# PERFORMANCE ANALYSIS OF TABLE VIII TANK GUNNERY ENGAGEMENTS

## Background

In attempting to attain and maintain readiness standards comparable to their Active Component (AC) counterparts, U.S. Army National Guard (ARNG) armor units face significant training challenges stemming from geographical dispersion, limited training time, and restricted access to range/maneuver areas (Eisley & Viner, 1988). Among these, perhaps the most pervasive challenge comes from the imposed limitations on training time (Eisley & Viner, 1989), i.e., 12 Inactive Duty Training (IDT) weekends and a 2-week Annual Training (AT) period per year (U.S. Army Training Board, 1987).

If AC armor units must train on a full-time basis to attain and maintain their readiness, then how can ARNG armor units be expected to do the same on a part-time basis? Clearly, some tasks must be trained at the expense of others.

Among others proposed (e.g., U.S. Army Armor School, 1993), one approach to reducing the task load in the training of tank gunnery is to emphasize tasks subject to live-fire evaluation, e.g., those required for tank crew qualification on Table VIII. Assuming that Table VIII includes a representative sample of critical intermediate-level gunnery tasks or engagements that armor crews must master to increase their chances of success in battle, then focusing on these engagements should promote training efficiency (i.e., save time) without compromising performance standards.

If one is willing to accept this line of reasoning, then further steps toward maximizing training efficiency could be taken by spending the majority of available training time on those Table VIII engagements found to be most difficult. In doing so, crews would undergo training where it is needed, i.e., on engagements that typically <u>are not</u> performed to standard (70 points or more), and forgo training where it is not needed, i.e., on engagements that typically <u>are</u> performed to standard.

To implement such a training approach, it is necessary for ARNG armor unit trainers to know which Table VIII engagements cause the most difficulty. This research provides this information.

## Method

### Participants

A total of 109 tank crews from three ARNG armor battalions, hereafter designated as Units A, B, and C, participated in the research.

## Procedure

Unit A fired Table VIII on the Multipurpose Range Complex (MPRC) at Yakima Firing Center, Washington, whereas Units B and C fired on the MPRC at Orchard Range, Idaho. Table VIII consisted of 10 engagements selected from among the 12 possible engagements, 6 day (Table VIIIA) and 6 night (Table VIIIB), prescribed in Field Manual (FM) 17-12-1-2 (Department of the Army, 1993) (see Table 1 for a description of each engagement). Of these 12 engagements, Unit A did not fire A5S and B5A; Units B and C did not fire A5A and B5. Engagements were scored by military tank crew evaluators (TCEs) who were not members of the units undergoing evaluation. If necessary, crews were allowed to make more than one run at qualification. Only first-run scores, however, were used to assess crew performance on each engagement.

Table 1

Table VIII Engagements

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### Table VIIIA (Day)

| Engagement | Description |
|---|---|
| A1 | On defense, engage a moving and a stationary tank with the main gun using GAS (gunner's auxiliary sight) battlesight gunnery. |
| A2 | On defense, simultaneously engage a stationary BMP (lightly armored vehicle) and a stationary RPG (rocket-propelled grenade) team with the main gun and tank commander's (TC's) Caliber .50 machine gun. |
| A3 | On offense, engage two stationary sets of troops with the coax machine gun using precision gunnery. |
| A4 | On offense, engage two stationary tanks with the main gun using precision gunnery under NBC (nuclear, biological, and chemical) protection status. |
| A5A | On offense, engage a stationary and a moving tank with the main gun using precision gunnery. |
| A5S | On offense, engage two moving tanks with the main gun using precision gunnery. |

(table continues)

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Table VIIIB (Night)

**Engagement**                **Description**

B1S     On defense, engage a stationary tank with the main
        gun from a three-man crew configuration using
        precision gunnery.

B2      On defense, engage two stationary BMPs with the main
        gun using precision gunnery.

B3      On offense, engage a stationary BMP and a stationary
        RPG team with the main gun and coax machine gun using
        precision gunnery under NBC protective status.

B4      On offense, engage a stationary and moving tank
        with the main gun using precision gunnery.

B5      On defense, engage a stationary tank with the main
        gun using GAS battlesight gunnery under external
        illumination.

B5A     On defense, engage a moving tank with the main gun
        using precision gunnery.

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Note. The targets for Engagement A2 have since been changed to a
stationary BMP and BTR (lightly armored vehicle) (Department of
the Army, 1993). A5S and B1S = swing tasks that can be fired
either day or night; A5A and B5A = alternate tasks that are fired
only when resources, weather, or range constraints prevent
execution of A5 and B5.

Results and Discussion

The average score for each engagement was calculated and
then ordinally ranked for difficulty for each unit separately and
then for the three units combined (only for the eight engagements
fired in common). As shown in Table 2, the average scores for
Unit A fell short of the 70 point minimum standard on 7 out of
the 10 engagements fired, while Units B and C did somewhat
better, falling short of the minimum standard on 5 and 4
engagements, respectively. For all three units, the same four
engagements (A1, A2, A3, and B3) had the lowest average scores
(highest difficulty rankings) and one engagement (B1S)
consistently had the highest average score (lowest difficulty
ranking).

Because Table VIII does not systematically vary conditions
across engagements, it is difficult to determine exactly why some
engagements were fired better than others. The engagement
descriptions in Table 1, however, do provide some bases for
speculation. For example, three of the four engagements found to

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be most difficult (A1, A2, A3, B3) required machine gun (coax or Caliber .50) employment either alone (A3) or in combination with the main gun (A2, B3), and also involved multiple targets. While other less difficult engagements also included multiple targets (i.e., A4, A5A, A5S, B2, B4), none required machine gun employment. Thus, it seems reasonable to conclude that machine gun usage was the primary cause of substandard performance. Unfortunately, the present data do not allow any further speculation on what specific aspect(s) of machine-gun-based engagements (e.g., target acquisition, firing technique, scoring procedure) created the problem.

Table 2

Average Scores (Difficulty Rankings) of Table VIII Engagements

| Table VIII Engagement | Units | | | |
|---|---|---|---|---|
| | A ($n$=47) | B ($n$=33) | C ($n$=29) | ABC ($N$=109) |
| A3 | 30 (1) | 54 (1) | 57 (2) | 45 (1) |
| B3 | 39 (3) | 55 (2) | 52 (1) | 48 (2) |
| A2 | 33 (2) | 62 (4) | 63 (4.5) | 50 (3) |
| A1 | 49 (4.5) | 57 (3) | 61 (3) | 55 (4) |
| B2 | 49 (4.5) | 78 (8.5) | 77 (8) | 65 (5) |
| A4 | 58 (6) | 72 (7) | 73 (6) | 66 (6) |
| A5S | -- | 67 (5) | 75 (7) | -- |
| B4 | 59 (7) | 78 (8.5) | 63 (4.5) | 70 (7) |
| B5A | -- | 70 (6) | 84 (9) | -- |
| B5 | 70 (8) | -- | -- | -- |
| A5A | 72 (9) | -- | -- | -- |
| B1S | 85 (10) | 87 (10) | 92 (10) | 88 (8) |

In the remaining engagement (A1) of the difficult foursome, crews engaged multiple targets, but this time using the GAS under a degraded mode condition resulting from computer and laser range finder (LRF) failure. Although use of the GAS was not associated

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with substandard performance when only a single, stationary target was presented (e.g., B5), Engagement A1 scores probably were low because one of the two targets presented was moving, thereby requiring the gunner to apply manual lead. This is a skill that ARNG tank crew gunners typically do not spend much time practicing either on the range or on training devices such as the Conduct-of-Fire Trainer (COFT) or Guard Unit Armory Device Full-Crew Interactive Simulation Trainer - Armor (GUARDFIST I).

The scores in Table 2 also suggest that crews generally performed better on single target engagements than on multiple target engagements. For Unit A, two of the three best engagements fired (B1S, B5) included only a single target. The same was true for Units B and C, although the specific engagements differed somewhat (B5A, B1S). In fact, the engagement on which all three units scored highest was B1S, even though it involved firing under the less than optimal three-man crew configuration (gunner position vacant). Aside from the above, no systematic differences in performance were apparent for other types of engagement variations involving visibility (day/night), firing tank movement (offense/defense), target movement (stationary/moving), main gun engagement technique (precision/battlesight), or protection status (NBC/non-NBC).

## Conclusions and Recommendations

The present results suggest that the limited gunnery training time of ARNG armor units should be focused on four specific engagements (A1, A2, A3, B3) in order to maximize the probability of first-run crew qualification on Tank Table VIII. Of these four engagements, all require machine gun employment alone or in combination with the main gun, or use of the GAS in engaging both a stationary and a moving target.

In training to become proficient on these four engagements, crews will also encounter many of the various conditions under which the remaining less difficult engagements are fired, i.e., variations in visibility, tank/target movement, main gun engagement technique, and protection status. Although some conditions, such as single target only, three-man crew, and precision moving target engagements, will not be encountered during training of the four most difficult engagements, the engagements that are fired under these conditions (e.g., B1S, B5A) typically are performed to standard, and thus, should require little or no training emphasis during preparation for Table VIII. In addition, training on the four most difficult engagements should improve (transfer positively to) performance on the easier engagements where conditions do overlap.

The finding that machine gun employment appears to be responsible for substandard performance on three of the four most difficult engagements underscores the importance of (a) live-fire

machine gun training/evaluation on Table V (Department of the Army, 1993), and (b) the capability for on-demand selection of machine gun oriented training exercises during device-based (e.g., COFT, GUARDFIST I) gunnery training. Unfortunately, the progression rules of the COFT Advanced Training Matrix have made on-demand exercise selection more cumbersome now than in the past (U.S. Army Armor Center and School, 1991).

Although the above approach suggests a way to reduce the gunnery training task load of ARNG armor units, thereby saving training time in the process, it does recommend "teaching the test" (or at least a subset of it) to enhance first-run Table VIII qualification rates. To the extent that Table VIII includes a representative, albeit non-exhaustive, sample of the types of critical engagements that crews must demonstrate proficiency on in order to win in battle, then teaching the test may be a good idea. Given the training time constraints and yearly gunnery evaluation demands placed on ARNG armor units, this approach should provide maximum payoff from the training time invested without compromising existing performance standards.

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